

Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 18-T2N-R65W

Crowder 16C-19HZ

Plan E Rev 0

Design: Actual Field Surveys

Sperry Drilling Services Standard Report

01 April, 2013

Well Coordinates: 1,296,487.36 N, 3,223,550.80 E (40° 08' 40.15" N, 104° 42' 01.21" W)

Ground Level: 4,952.00 ft

Local Coordinate Origin:

Centered on Well Crowder 16C-19HZ

Viewing Datum:

RKB=25 @ 4977.00ft (HP 308)

TVDs to System:

N

North Reference:

True

Unit System:

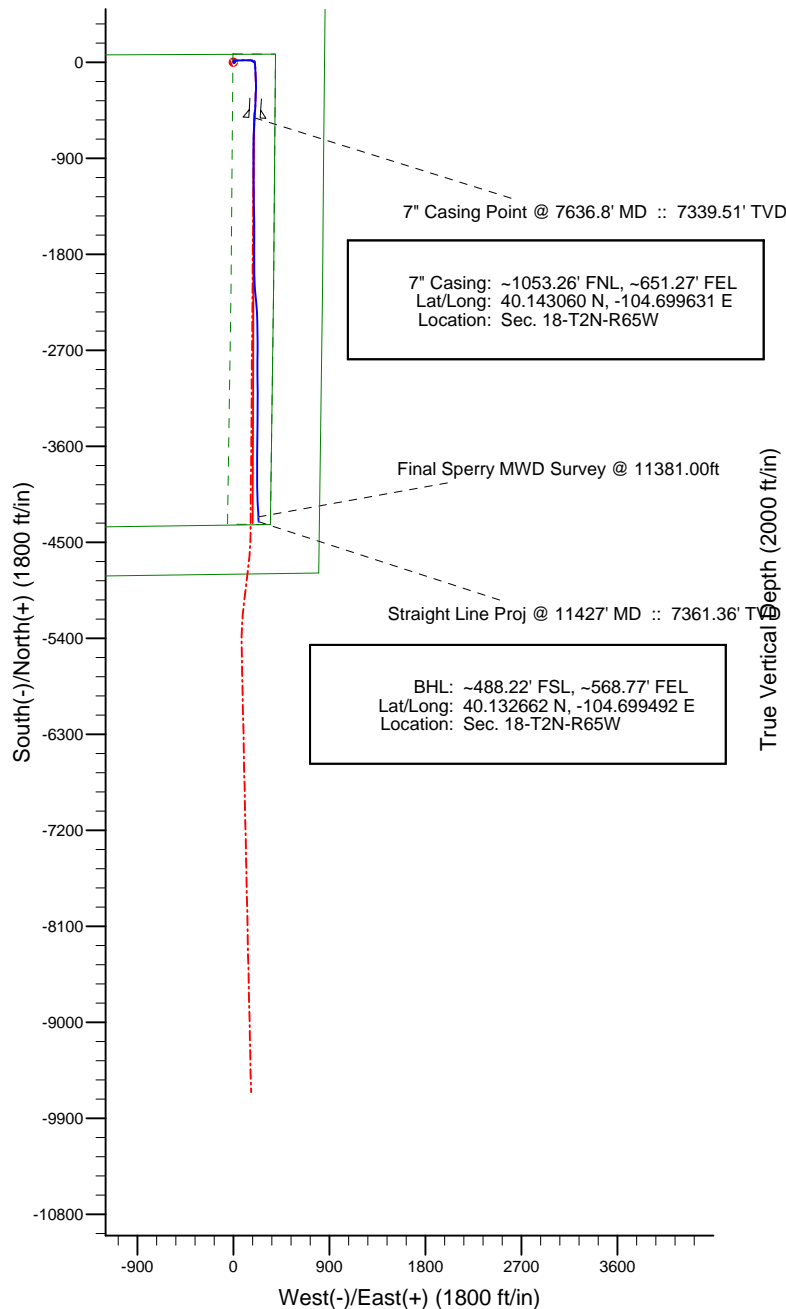
API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 43I

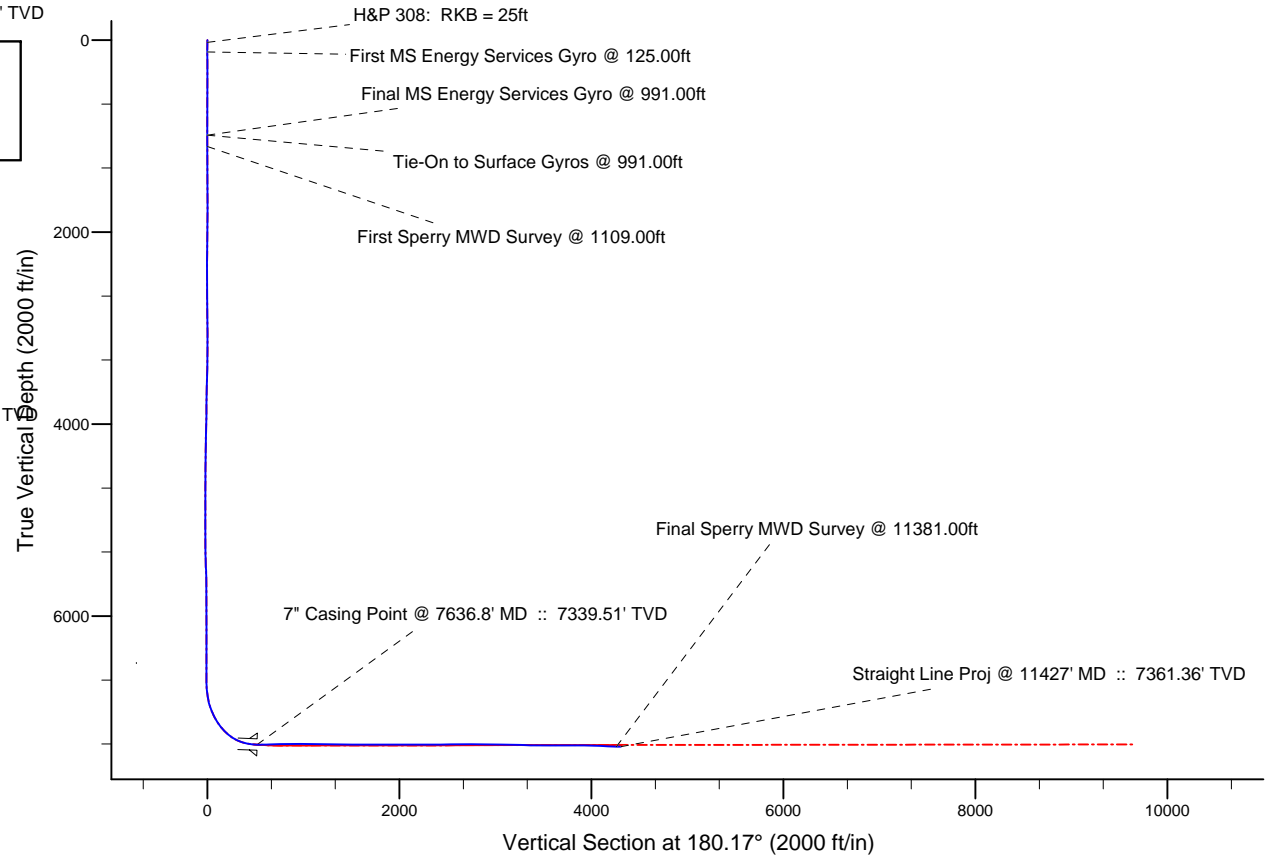
HALLIBURTON

Project: Weld County, CO (NAD 83)
 Site: Sec. 18-T2N-R65W
 Well: Crowder 16C-19HZ
 Wellbore: Plan E Rev 0
 Design: Actual Field Surveys



LEGEND

- - - Crowder 16C-19HZ, Plan D Rev 0, Plan D Rev 0 PROPOSAL V0
- - - Crowder 16C-19HZ, Plan E Rev 0, Plan E Rev 0 PROPOSAL V0
- - - Actual Field Surveys



WELL DETAILS: Crowder 16C-19HZ	
Ground Level: 4952.00	
RKB=25 @ 4977.00ft (HP 308)	
Design: Actual Field Surveys (Crowder 16C-19HZ/Plan E Rev 0)	
Created By: Fred Hartmann	Date: 04/01/2013
Reviewed: _____	Date: _____

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00
H&P 308: RKB = 25ft							
125.00	0.31	271.15	125.00	0.01	-0.27	0.00	0.31
First MS Energy Services Gyro @ 125.00ft							
225.00	0.23	124.65	225.00	-0.10	-0.38	0.10	0.52
325.00	0.20	326.19	325.00	-0.07	-0.31	0.07	0.42
425.00	0.34	117.03	425.00	-0.06	-0.14	0.06	0.52
525.00	0.25	333.78	525.00	0.00	0.03	0.00	0.56
625.00	0.34	43.59	625.00	0.41	0.14	-0.41	0.35
725.00	0.48	63.13	724.99	0.81	0.71	-0.82	0.20
825.00	0.43	107.84	824.99	0.89	1.44	-0.89	0.35
925.00	0.39	145.10	924.99	0.49	2.00	-0.50	0.26
991.00	0.30	75.10	990.99	0.35	2.29	-0.36	0.61
Final MS Energy Services Gyro @ 991.00ft - Tie-On to Surface Gyros @ 991.00ft							
1,109.00	0.50	166.65	1,108.99	-0.07	2.71	0.06	0.50
First Sperry MWD Survey @ 1109.00ft							
1,298.00	0.50	75.55	1,297.98	-0.66	3.70	0.65	0.38
1,488.00	0.37	169.27	1,487.98	-1.06	4.62	1.05	0.34
1,672.00	0.58	171.04	1,671.97	-2.56	4.87	2.55	0.11
1,764.00	1.11	76.96	1,763.96	-2.82	5.81	2.81	1.40
1,948.00	1.10	66.12	1,947.93	-1.71	9.16	1.68	0.11
2,132.00	1.35	41.96	2,131.89	0.62	12.23	-0.66	0.31
2,316.00	0.23	27.30	2,315.87	2.56	13.85	-2.60	0.61
2,500.00	0.28	96.80	2,499.87	2.84	14.46	-2.88	0.16
2,684.00	0.39	224.74	2,683.87	2.34	14.47	-2.38	0.33
2,868.00	1.45	229.85	2,867.84	0.39	12.25	-0.43	0.58
3,051.00	1.20	233.15	3,050.79	-2.25	8.94	2.22	0.14
3,143.00	0.84	203.13	3,142.78	-3.45	7.91	3.42	0.69
3,235.00	1.43	328.41	3,234.77	-3.09	7.04	3.07	2.21
3,421.00	1.28	325.43	3,420.71	0.60	4.65	-0.61	0.09
3,611.00	1.85	328.21	3,610.64	4.95	1.83	-4.96	0.30
3,800.00	1.34	283.32	3,799.58	8.05	-1.93	-8.05	0.69
3,895.00	1.37	26.98	3,894.56	9.32	-2.50	-9.31	2.24
3,989.00	3.19	64.50	3,988.49	11.45	0.37	-11.45	2.41
4,084.00	4.54	76.57	4,083.27	13.46	6.42	-13.48	1.65
4,179.00	5.83	83.39	4,177.88	14.89	14.87	-14.93	1.50
4,273.00	7.50	83.95	4,271.24	16.09	25.71	-16.16	1.78
4,368.00	7.77	82.64	4,365.40	17.56	38.25	-17.68	0.34
4,462.00	8.58	86.82	4,458.44	18.77	51.55	-18.92	1.07
4,557.00	9.85	89.13	4,552.22	19.28	66.75	-19.48	1.39
4,652.00	8.71	85.39	4,645.97	19.98	82.05	-20.23	1.36
4,746.00	9.74	92.29	4,738.76	20.24	97.09	-20.53	1.61
4,841.00	9.22	91.42	4,832.46	19.73	112.72	-20.06	0.57
4,935.00	8.35	90.87	4,925.36	19.44	127.08	-19.81	0.93
5,030.00	7.36	87.40	5,019.46	19.61	140.05	-20.02	1.16
5,124.00	6.65	88.69	5,112.76	20.01	151.51	-20.46	0.77
5,219.00	4.99	91.70	5,207.27	20.01	161.14	-20.49	1.78
5,313.00	4.50	94.99	5,300.95	19.57	168.90	-20.07	0.60
5,408.00	2.56	147.58	5,395.78	17.45	173.75	-17.97	3.77

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
5,503.00	2.09	175.86	5,490.71	13.93	175.01	-14.45	1.29
5,597.00	3.21	112.45	5,584.62	11.22	177.57	-11.74	3.13
5,692.00	3.08	112.36	5,679.48	9.23	182.39	-9.77	0.14
5,786.00	1.70	112.77	5,773.40	7.73	186.01	-8.28	1.47
5,976.00	1.00	59.62	5,963.35	7.48	190.04	-8.04	0.72
6,165.00	0.65	60.12	6,152.33	8.85	192.39	-9.42	0.19
6,354.00	0.57	92.74	6,341.32	9.34	194.26	-9.91	0.19
6,543.00	0.43	106.00	6,530.31	9.10	195.88	-9.68	0.10
6,638.00	0.71	122.20	6,625.31	8.68	196.72	-9.27	0.34
6,669.00	0.68	141.05	6,656.31	8.44	197.00	-9.02	0.74
6,701.00	1.09	152.06	6,688.30	8.02	197.26	-8.61	1.38
6,732.00	2.36	162.76	6,719.29	7.15	197.59	-7.74	4.21
6,764.00	3.97	163.12	6,751.24	5.46	198.11	-6.05	5.03
6,796.00	5.84	169.52	6,783.12	2.80	198.72	-3.39	6.08
6,827.00	8.10	174.31	6,813.89	-0.92	199.23	0.33	7.52
6,859.00	9.41	175.58	6,845.52	-5.78	199.65	5.18	4.14
6,890.00	11.49	170.52	6,876.00	-11.35	200.36	10.75	7.33
6,922.00	14.55	173.92	6,907.17	-18.49	201.31	17.89	9.85
6,953.00	17.66	174.36	6,936.95	-27.04	202.18	26.44	10.04
6,985.00	20.37	174.39	6,967.20	-37.42	203.20	36.82	8.47
7,016.00	22.66	176.77	6,996.04	-48.75	204.07	48.15	7.90
7,048.00	25.24	177.55	7,025.29	-61.73	204.71	61.12	8.12
7,079.00	27.84	177.58	7,053.02	-75.56	205.30	74.95	8.39
7,111.00	30.13	177.44	7,081.01	-91.05	205.97	90.44	7.16
7,142.00	32.93	178.57	7,107.43	-107.25	206.53	106.64	9.23
7,174.00	36.08	177.69	7,133.79	-125.37	207.12	124.75	9.97
7,205.00	38.76	177.34	7,158.41	-144.19	207.94	143.57	8.67
7,240.00	42.39	177.66	7,184.99	-166.93	208.93	166.31	10.39
7,272.00	45.55	177.80	7,208.02	-189.12	209.81	188.50	9.88
7,303.00	49.46	180.15	7,228.96	-211.97	210.21	211.34	13.79
7,335.00	53.38	180.95	7,248.91	-236.98	209.96	236.35	12.40
7,367.00	57.10	181.07	7,267.15	-263.26	209.50	262.64	11.63
7,398.00	60.86	181.44	7,283.13	-289.81	208.91	289.19	12.17
7,430.00	64.92	181.78	7,297.70	-318.28	208.11	317.66	12.72
7,461.00	69.58	182.04	7,309.69	-346.85	207.16	346.23	15.05
7,492.00	74.31	182.22	7,319.29	-376.29	206.06	375.68	15.27
7,524.00	78.00	183.28	7,326.95	-407.32	204.57	406.71	11.97
7,556.00	80.97	183.96	7,332.79	-438.72	202.58	438.11	9.51
7,591.00	85.43	183.78	7,336.93	-473.38	200.24	472.78	12.75
7,636.80	88.11	183.66	7,339.51	-519.01	197.27	518.42	5.85
7" Casing Point @ 7636.8' MD :: 7339.51' TVD							
7,703.00	91.98	183.49	7,339.46	-585.07	193.14	584.49	5.85
7,797.00	90.68	180.84	7,337.28	-678.96	189.59	678.40	3.14
7,892.00	91.54	180.83	7,335.44	-773.93	188.21	773.37	0.91
7,986.00	90.68	179.94	7,333.62	-867.91	187.58	867.35	1.32
8,078.00	89.94	179.88	7,333.12	-959.91	187.72	959.35	0.81
8,169.00	89.51	179.66	7,333.56	-1,050.91	188.09	1,050.35	0.53
8,262.00	89.81	179.47	7,334.11	-1,143.90	188.80	1,143.34	0.38
8,354.00	88.64	179.35	7,335.35	-1,235.89	189.74	1,235.32	1.28
8,446.00	89.01	178.74	7,337.24	-1,327.86	191.28	1,327.28	0.78
8,537.00	89.63	179.12	7,338.32	-1,418.83	192.97	1,418.26	0.80

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
8,629.00	89.88	180.02	7,338.71	-1,510.83	193.67	1,510.25	1.02
8,721.00	90.25	180.06	7,338.61	-1,602.83	193.60	1,602.25	0.40
8,813.00	89.32	180.33	7,338.96	-1,694.83	193.29	1,694.25	1.05
8,905.00	89.81	179.87	7,339.65	-1,786.82	193.13	1,786.24	0.73
8,996.00	89.81	179.12	7,339.96	-1,877.82	193.93	1,877.24	0.82
9,088.00	90.93	178.95	7,339.36	-1,969.80	195.48	1,969.21	1.23
9,180.00	89.51	178.47	7,339.01	-2,061.78	197.55	2,061.18	1.63
9,273.00	89.51	174.57	7,339.80	-2,154.58	203.19	2,153.97	4.19
9,365.00	90.56	175.21	7,339.75	-2,246.22	211.39	2,245.58	1.34
9,456.00	89.38	175.87	7,339.80	-2,336.94	218.46	2,336.28	1.49
9,548.00	91.24	178.32	7,339.30	-2,428.81	223.13	2,428.13	3.34
9,641.00	91.30	179.19	7,337.24	-2,521.76	225.15	2,521.08	0.94
9,733.00	90.19	179.13	7,336.04	-2,613.74	226.49	2,613.06	1.21
9,825.00	90.49	181.06	7,335.49	-2,705.74	226.34	2,705.05	2.12
9,919.00	89.01	180.32	7,335.90	-2,799.73	225.21	2,799.04	1.76
10,014.00	89.38	180.17	7,337.24	-2,894.71	224.80	2,894.04	0.42
10,108.00	89.69	178.92	7,338.00	-2,988.71	225.55	2,988.02	1.37
10,203.00	89.07	179.31	7,339.03	-3,083.69	227.02	3,083.00	0.77
10,297.00	88.45	180.65	7,341.06	-3,177.66	227.05	3,176.98	1.57
10,392.00	88.21	180.28	7,343.83	-3,272.62	226.28	3,271.94	0.46
10,487.00	88.52	180.54	7,346.54	-3,367.58	225.60	3,366.90	0.43
10,582.00	89.75	180.98	7,347.98	-3,462.56	224.34	3,461.88	1.38
10,676.00	90.19	180.55	7,348.03	-3,556.55	223.09	3,555.87	0.65
10,771.00	90.74	180.03	7,347.26	-3,651.54	222.60	3,650.87	0.80
10,866.00	90.06	181.22	7,346.59	-3,746.53	221.57	3,745.86	1.44
10,960.00	88.89	180.22	7,347.45	-3,840.52	220.39	3,839.85	1.64
11,055.00	89.38	179.95	7,348.89	-3,935.51	220.25	3,934.84	0.59
11,150.00	88.33	178.13	7,350.79	-4,030.47	221.84	4,029.80	2.21
11,244.00	86.72	176.61	7,354.85	-4,124.28	226.15	4,123.59	2.35
11,339.00	88.27	176.87	7,359.00	-4,219.03	231.54	4,218.33	1.65
11,381.00	88.52	176.94	7,360.17	-4,260.95	233.81	4,260.24	0.62
Final Sperry MWD Survey @ 11381.00ft							
11,427.00	88.52	176.94	7,361.36	-4,306.87	236.26	4,306.15	0.00
Straight Line Proj @ 11427' MD :: 7361.36' TVD							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
25.00	25.00	0.00	0.00	H&P 308: RKB = 25ft
125.00	125.00	0.01	-0.27	First MS Energy Services Gyro @ 125.00ft
991.00	990.99	0.35	2.29	Final MS Energy Services Gyro @ 991.00ft
991.00	990.99	0.35	2.29	Tie-On to Surface Gyros @ 991.00ft
1,109.00	1,108.99	-0.07	2.71	First Sperry MWD Survey @ 1109.00ft
11,381.00	7,360.17	-4,260.95	233.81	Final Sperry MWD Survey @ 11381.00ft
11,427.00	7,361.36	-4,306.87	236.26	Straight Line Proj @ 11427' MD :: 7361.36' TVD

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (ft)	Origin +E/-W (ft)	Start TVD (ft)
User	No Target (Freehand)	180.17	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
25.00	991.00	MS Energy Services - Surface Gyros	NS-GYRO-MS
1,109.00	7,591.00	Sperry MWD Surveys - Vert/Build	MWD+IFR1+SC
7,703.00	11,381.00	Sperry MWD Surveys - Lateral	MWD+IFR1+SC

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,636.80	7,339.51	7" Casing Point @ 7636.8' MD :: 7339.51' TVD	7	8-3/4

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Crowder 16C-19HZ_ - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,296,487.36	3,223,550.80	40.144485	-104.700337
Point 1				-5.58	79.03	1,296,566.33	3,223,544.50		
Point 2				-23.91	-2,115.29	1,294,372.02	3,223,545.96		
Point 3				-56.50	-4,329.84	1,292,157.36	3,223,533.34		
Point 4				344.62	-4,333.46	1,292,157.36	3,223,934.46		
Point 5				375.10	-2,118.89	1,294,372.02	3,223,944.97		
Point 6				393.63	75.43	1,296,566.33	3,223,943.71		
Point 7				-5.58	79.03	1,296,566.33	3,223,544.50		
Crowder 16C-19HZ_ - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,296,487.36	3,223,550.80	40.144485	-104.700337
Point 1				-3,894.73	58.69	1,296,510.92	3,219,655.86		
Point 2				-3,899.29	-2,166.96	1,294,285.41	3,219,671.37		
Point 3				-3,899.47	-4,393.15	1,292,059.40	3,219,691.26		
Point 4				-1,835.48	-4,363.12	1,292,108.04	3,221,754.81		
Point 5				344.62	-4,333.46	1,292,157.36	3,223,934.46		
Point 6				375.10	-2,118.89	1,294,372.02	3,223,944.97		
Point 7				386.26	-783.74	1,295,707.16	3,223,944.09		
Point 8				393.63	75.43	1,296,566.33	3,223,943.71		
Point 9				-1,792.74	67.02	1,296,538.20	3,221,757.60		
Point 10				-3,894.73	58.69	1,296,510.92	3,219,655.86		
Crowder 16C-19HZ_ - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,296,487.36	3,223,550.80	40.144485	-104.700337
Point 1				-4,353.81	516.89	1,296,964.94	3,219,192.68		
Point 2				-4,359.30	-2,172.17	1,294,276.05	3,219,211.44		
Point 3				-4,359.54	-4,859.92	1,291,588.52	3,219,235.44		
Point 4				-1,839.93	-4,823.25	1,291,647.91	3,221,754.51		
Point 5				798.44	-4,787.34	1,291,707.61	3,224,392.34		
Point 6				835.17	-2,113.99	1,294,381.07	3,224,404.96		
Point 7				846.26	-787.68	1,295,707.37	3,224,404.09		
Point 8				857.62	537.24	1,297,032.28	3,224,403.50		
Point 9				-1,788.30	527.06	1,296,998.25	3,221,757.89		
Point 10				-4,353.81	516.89	1,296,964.94	3,219,192.68		
Crowder 16C-19HZ_ - actual wellpath misses target center by 60.63ft at 11427.00ft MD (7361.36 TVD, -4306.87 N, 236.26 E) - Point	0.00	0.00	7,343.87	-4,321.18	180.00	1,292,168.15	3,223,769.75	40.132623	-104.699693
Crowder 16C-19HZ_ - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	1,296,487.36	3,223,550.80	40.144485	-104.700337

North Reference Sheet for Sec. 18-T2N-R65W - Crowder 16C-19HZ - Plan E Rev 0

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.

Vertical Depths are relative to RKB=25 @ 4977.00ft (HP 308). Northing and Easting are relative to Crowder 16C-19HZ

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995856

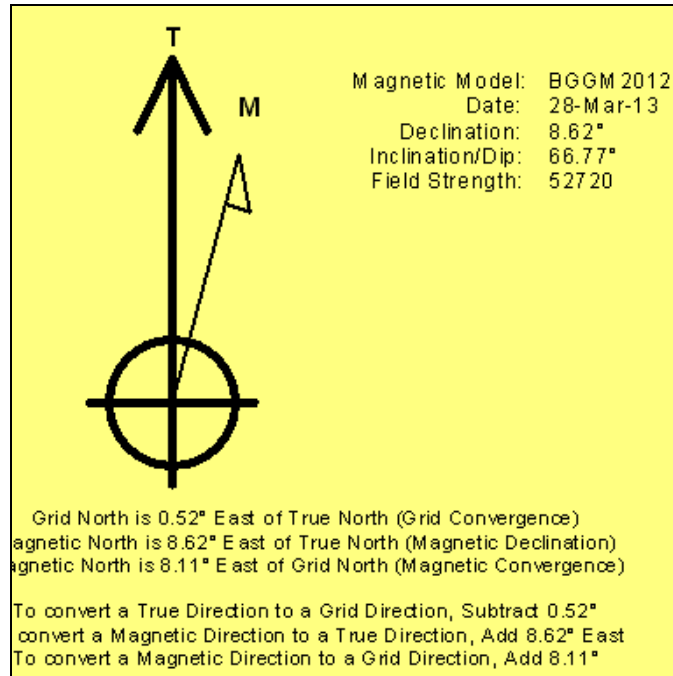
Grid Coordinates of Well: 1,296,487.36 ft N, 3,223,550.80 ft E

Geographical Coordinates of Well: 40° 08' 40.15" N, 104° 42' 01.21" W

Grid Convergence at Surface is: 0.52°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,427.00ft the Bottom Hole Displacement is 4,313.35ft in the Direction of 176.86° (True).

Magnetic Convergence at surface is: -8.11° (28 March 2013, , BGGM2012)



Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 18-T2N-R65W

Crowder 16C-19HZ

Plan E Rev 0

Design: Actual Field Surveys

Sperry Drilling Services Geodetic Report

01 April, 2013

Well Coordinates: 1,296,487.36 N, 3,223,550.80 E (40° 08' 40.15" N, 104° 42' 01.21" W)

Ground Level: 4,952.00 ft

Local Coordinate Origin:	Centered on Well Crowder 16C-19HZ
Viewing Datum:	RKB=25 @ 4977.00ft (HP 308)
TVDs to System:	N
North Reference:	True
Unit System:	API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 431

HALLIBURTON

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (ft)	+E/-W (ft)	Latitude (ft)	Longitude (ft)	Northing (ft)	Easting (ft)
0.00	0.00	0.00	0.00	0.00	0.00	40.144485	-104.700337	1,296,487.36	3,223,550.80
25.00	0.00	0.00	25.00	0.00	0.00	40.144485	-104.700337	1,296,487.36	3,223,550.80
125.00	0.31	271.15	125.00	0.01	-0.27	40.144485	-104.700338	1,296,487.36	3,223,550.52
225.00	0.23	124.65	225.00	-0.10	-0.38	40.144485	-104.700338	1,296,487.25	3,223,550.42
325.00	0.20	326.19	325.00	-0.07	-0.31	40.144485	-104.700338	1,296,487.28	3,223,550.49
425.00	0.34	117.03	425.00	-0.06	-0.14	40.144485	-104.700338	1,296,487.29	3,223,550.65
525.00	0.25	333.78	525.00	0.00	0.03	40.144485	-104.700337	1,296,487.35	3,223,550.82
625.00	0.34	43.59	625.00	0.41	0.14	40.144486	-104.700337	1,296,487.77	3,223,550.93
725.00	0.48	63.13	724.99	0.81	0.71	40.144487	-104.700334	1,296,488.18	3,223,551.50
825.00	0.43	107.84	824.99	0.89	1.44	40.144487	-104.700332	1,296,488.26	3,223,552.23
925.00	0.39	145.10	924.99	0.49	2.00	40.144486	-104.700330	1,296,487.87	3,223,552.79
991.00	0.30	75.10	990.99	0.35	2.29	40.144486	-104.700329	1,296,487.73	3,223,553.08
1,109.00	0.50	166.65	1,108.99	-0.07	2.71	40.144485	-104.700327	1,296,487.31	3,223,553.50
1,298.00	0.50	75.55	1,297.98	-0.66	3.70	40.144483	-104.700324	1,296,486.72	3,223,554.50
1,488.00	0.37	169.27	1,487.98	-1.06	4.62	40.144482	-104.700320	1,296,486.34	3,223,555.42
1,672.00	0.58	171.04	1,671.97	-2.56	4.87	40.144478	-104.700320	1,296,484.84	3,223,555.69
1,764.00	1.11	76.96	1,763.96	-2.82	5.81	40.144477	-104.700316	1,296,484.59	3,223,556.63
1,948.00	1.10	66.12	1,947.93	-1.71	9.16	40.144480	-104.700304	1,296,485.73	3,223,559.97
2,132.00	1.35	41.96	2,131.89	0.62	12.23	40.144487	-104.700293	1,296,488.09	3,223,563.02
2,316.00	0.23	27.30	2,315.87	2.56	13.85	40.144492	-104.700287	1,296,490.04	3,223,564.62
2,500.00	0.28	96.80	2,499.87	2.84	14.46	40.144493	-104.700285	1,296,490.32	3,223,565.23
2,684.00	0.39	224.74	2,683.87	2.34	14.47	40.144491	-104.700285	1,296,489.82	3,223,565.24
2,868.00	1.45	229.85	2,867.84	0.39	12.25	40.144486	-104.700293	1,296,487.86	3,223,563.04
3,051.00	1.20	233.15	3,050.79	-2.25	8.94	40.144479	-104.700305	1,296,485.19	3,223,559.76
3,143.00	0.84	203.13	3,142.78	-3.45	7.91	40.144476	-104.700309	1,296,483.98	3,223,558.73
3,235.00	1.43	328.41	3,234.77	-3.09	7.04	40.144477	-104.700312	1,296,484.33	3,223,557.86
3,421.00	1.28	325.43	3,420.71	0.60	4.65	40.144487	-104.700320	1,296,487.99	3,223,555.44
3,611.00	1.85	328.21	3,610.64	4.95	1.83	40.144499	-104.700330	1,296,492.32	3,223,552.58
3,800.00	1.34	283.32	3,799.58	8.05	-1.93	40.144507	-104.700344	1,296,495.39	3,223,548.79
3,895.00	1.37	26.98	3,894.56	9.32	-2.50	40.144511	-104.700346	1,296,496.65	3,223,548.21
3,989.00	3.19	64.50	3,988.49	11.45	0.37	40.144516	-104.700336	1,296,498.81	3,223,551.07
4,084.00	4.54	76.57	4,083.27	13.46	6.42	40.144522	-104.700314	1,296,500.87	3,223,557.09
4,179.00	5.83	83.39	4,177.88	14.89	14.87	40.144526	-104.700284	1,296,502.38	3,223,565.53
4,273.00	7.50	83.95	4,271.24	16.09	25.71	40.144529	-104.700245	1,296,503.67	3,223,576.36
4,368.00	7.77	82.64	4,365.40	17.56	38.25	40.144533	-104.700200	1,296,505.26	3,223,588.88
4,462.00	8.58	86.82	4,458.44	18.77	51.55	40.144536	-104.700153	1,296,506.58	3,223,602.17
4,557.00	9.85	89.13	4,552.22	19.28	66.75	40.144538	-104.700098	1,296,507.24	3,223,617.37
4,652.00	8.71	85.39	4,645.97	19.98	82.05	40.144540	-104.700044	1,296,508.08	3,223,632.65
4,746.00	9.74	92.29	4,738.76	20.24	97.09	40.144541	-104.699990	1,296,508.47	3,223,647.69
4,841.00	9.22	91.42	4,832.46	19.73	112.72	40.144539	-104.699934	1,296,508.10	3,223,663.33
4,935.00	8.35	90.87	4,925.36	19.44	127.08	40.144538	-104.699882	1,296,507.94	3,223,677.69
5,030.00	7.36	87.40	5,019.46	19.61	140.05	40.144539	-104.699836	1,296,508.23	3,223,690.66

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (ft)	+E/-W (ft)	Latitude (ft)	Longitude (ft)	Northing (ft)	Easting (ft)
5,124.00	6.65	88.69	5,112.76	20.01	151.51	40.144540	-104.699795	1,296,508.73	3,223,702.11
5,219.00	4.99	91.70	5,207.27	20.01	161.14	40.144540	-104.699761	1,296,508.82	3,223,711.74
5,313.00	4.50	94.99	5,300.95	19.57	168.90	40.144539	-104.699733	1,296,508.44	3,223,719.50
5,408.00	2.56	147.58	5,395.78	17.45	173.75	40.144533	-104.699716	1,296,506.37	3,223,724.37
5,503.00	2.09	175.86	5,490.71	13.93	175.01	40.144523	-104.699711	1,296,502.87	3,223,725.67
5,597.00	3.21	112.45	5,584.62	11.22	177.57	40.144516	-104.699702	1,296,500.17	3,223,728.25
5,692.00	3.08	112.36	5,679.48	9.23	182.39	40.144510	-104.699685	1,296,498.23	3,223,733.09
5,786.00	1.70	112.77	5,773.40	7.73	186.01	40.144506	-104.699672	1,296,496.76	3,223,736.72
5,976.00	1.00	59.62	5,963.35	7.48	190.04	40.144506	-104.699657	1,296,496.55	3,223,740.75
6,165.00	0.65	60.12	6,152.33	8.85	192.39	40.144509	-104.699649	1,296,497.94	3,223,743.09
6,354.00	0.57	92.74	6,341.32	9.34	194.26	40.144511	-104.699642	1,296,498.44	3,223,744.96
6,543.00	0.43	106.00	6,530.31	9.10	195.88	40.144510	-104.699636	1,296,498.22	3,223,746.58
6,638.00	0.71	122.20	6,625.31	8.68	196.72	40.144509	-104.699633	1,296,497.81	3,223,747.42
6,669.00	0.68	141.05	6,656.31	8.44	197.00	40.144508	-104.699632	1,296,497.57	3,223,747.70
6,701.00	1.09	152.06	6,688.30	8.02	197.26	40.144507	-104.699631	1,296,497.16	3,223,747.97
6,732.00	2.36	162.76	6,719.29	7.15	197.59	40.144505	-104.699630	1,296,496.29	3,223,748.30
6,764.00	3.97	163.12	6,751.24	5.46	198.11	40.144500	-104.699628	1,296,494.60	3,223,748.84
6,796.00	5.84	169.52	6,783.12	2.80	198.72	40.144493	-104.699626	1,296,491.95	3,223,749.48
6,827.00	8.10	174.31	6,813.89	-0.92	199.23	40.144482	-104.699624	1,296,488.23	3,223,750.01
6,859.00	9.41	175.58	6,845.52	-5.78	199.65	40.144469	-104.699623	1,296,483.38	3,223,750.48
6,890.00	11.49	170.52	6,876.00	-11.35	200.36	40.144454	-104.699620	1,296,477.81	3,223,751.24
6,922.00	14.55	173.92	6,907.17	-18.49	201.31	40.144434	-104.699617	1,296,470.68	3,223,752.25
6,953.00	17.66	174.36	6,936.95	-27.04	202.18	40.144411	-104.699614	1,296,462.14	3,223,753.20
6,985.00	20.37	174.39	6,967.20	-37.42	203.20	40.144382	-104.699610	1,296,451.77	3,223,754.32
7,016.00	22.66	176.77	6,996.04	-48.75	204.07	40.144351	-104.699607	1,296,440.45	3,223,755.29
7,048.00	25.24	177.55	7,025.29	-61.73	204.71	40.144316	-104.699605	1,296,427.48	3,223,756.04
7,079.00	27.84	177.58	7,053.02	-75.56	205.30	40.144278	-104.699603	1,296,413.65	3,223,756.75
7,111.00	30.13	177.44	7,081.01	-91.05	205.97	40.144235	-104.699600	1,296,398.17	3,223,757.57
7,142.00	32.93	178.57	7,107.43	-107.25	206.53	40.144191	-104.699598	1,296,381.97	3,223,758.27
7,174.00	36.08	177.69	7,133.79	-125.37	207.12	40.144141	-104.699596	1,296,363.87	3,223,759.03
7,205.00	38.76	177.34	7,158.41	-144.19	207.94	40.144089	-104.699593	1,296,345.06	3,223,760.02
7,240.00	42.39	177.66	7,184.99	-166.93	208.93	40.144027	-104.699590	1,296,322.33	3,223,761.22
7,272.00	45.55	177.80	7,208.02	-189.12	209.81	40.143966	-104.699587	1,296,300.14	3,223,762.30
7,303.00	49.46	180.15	7,228.96	-211.97	210.21	40.143903	-104.699585	1,296,277.30	3,223,762.90
7,335.00	53.38	180.95	7,248.91	-236.98	209.96	40.143834	-104.699586	1,296,252.29	3,223,762.88
7,367.00	57.10	181.07	7,267.15	-263.26	209.50	40.143762	-104.699588	1,296,226.01	3,223,762.65
7,398.00	60.86	181.44	7,283.13	-289.81	208.91	40.143689	-104.699590	1,296,199.45	3,223,762.31
7,430.00	64.92	181.78	7,297.70	-318.28	208.11	40.143611	-104.699593	1,296,170.98	3,223,761.76
7,461.00	69.58	182.04	7,309.69	-346.85	207.16	40.143533	-104.699596	1,296,142.41	3,223,761.06
7,492.00	74.31	182.22	7,319.29	-376.29	206.06	40.143452	-104.699600	1,296,112.95	3,223,760.23
7,524.00	78.00	183.28	7,326.95	-407.32	204.57	40.143367	-104.699605	1,296,081.91	3,223,759.02
7,556.00	80.97	183.96	7,332.79	-438.72	202.58	40.143281	-104.699612	1,296,050.50	3,223,757.32

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (ft)	+E/-W (ft)	Latitude (ft)	Longitude (ft)	Northing (ft)	Easting (ft)
7,591.00	85.43	183.78	7,336.93	-473.38	200.24	40.143186	-104.699621	1,296,015.82	3,223,755.29
7,636.80	88.11	183.66	7,339.51	-519.01	197.27	40.143060	-104.699631	1,295,970.17	3,223,752.73
7,703.00	91.98	183.49	7,339.46	-585.07	193.14	40.142879	-104.699646	1,295,904.08	3,223,749.20
7,797.00	90.68	180.84	7,337.28	-678.96	189.59	40.142621	-104.699659	1,295,810.16	3,223,746.50
7,892.00	91.54	180.83	7,335.44	-773.93	188.21	40.142361	-104.699664	1,295,715.18	3,223,745.97
7,986.00	90.68	179.94	7,333.62	-867.91	187.58	40.142103	-104.699666	1,295,621.20	3,223,746.19
8,078.00	89.94	179.88	7,333.12	-959.91	187.72	40.141850	-104.699666	1,295,529.22	3,223,747.16
8,169.00	89.51	179.66	7,333.56	-1,050.91	188.09	40.141600	-104.699664	1,295,438.23	3,223,748.35
8,262.00	89.81	179.47	7,334.11	-1,143.90	188.80	40.141345	-104.699662	1,295,345.25	3,223,749.89
8,354.00	88.64	179.35	7,335.35	-1,235.89	189.74	40.141092	-104.699658	1,295,253.28	3,223,751.67
8,446.00	89.01	178.74	7,337.24	-1,327.86	191.28	40.140840	-104.699653	1,295,161.33	3,223,754.03
8,537.00	89.63	179.12	7,338.32	-1,418.83	192.97	40.140590	-104.699647	1,295,070.38	3,223,756.55
8,629.00	89.88	180.02	7,338.71	-1,510.83	193.67	40.140338	-104.699644	1,294,978.40	3,223,758.07
8,721.00	90.25	180.06	7,338.61	-1,602.83	193.60	40.140085	-104.699645	1,294,886.40	3,223,758.83
8,813.00	89.32	180.33	7,338.96	-1,694.83	193.29	40.139833	-104.699646	1,294,794.41	3,223,759.35
8,905.00	89.81	179.87	7,339.65	-1,786.82	193.13	40.139580	-104.699646	1,294,702.42	3,223,760.02
8,996.00	89.81	179.12	7,339.96	-1,877.82	193.93	40.139330	-104.699643	1,294,611.44	3,223,761.64
9,088.00	90.93	178.95	7,339.36	-1,969.80	195.48	40.139078	-104.699638	1,294,519.48	3,223,764.02
9,180.00	89.51	178.47	7,339.01	-2,061.78	197.55	40.138825	-104.699630	1,294,427.53	3,223,766.92
9,273.00	89.51	174.57	7,339.80	-2,154.58	203.19	40.138571	-104.699610	1,294,334.78	3,223,773.40
9,365.00	90.56	175.21	7,339.75	-2,246.22	211.39	40.138319	-104.699581	1,294,243.23	3,223,782.42
9,456.00	89.38	175.87	7,339.80	-2,336.94	218.46	40.138070	-104.699556	1,294,152.58	3,223,790.31
9,548.00	91.24	178.32	7,339.30	-2,428.81	223.13	40.137818	-104.699539	1,294,060.76	3,223,795.80
9,641.00	91.30	179.19	7,337.24	-2,521.76	225.15	40.137563	-104.699532	1,293,967.83	3,223,798.66
9,733.00	90.19	179.13	7,336.04	-2,613.74	226.49	40.137310	-104.699527	1,293,875.87	3,223,800.84
9,825.00	90.49	181.06	7,335.49	-2,705.74	226.34	40.137058	-104.699527	1,293,783.88	3,223,801.52
9,919.00	89.01	180.32	7,335.90	-2,799.73	225.21	40.136800	-104.699532	1,293,689.89	3,223,801.23
10,014.00	89.38	180.17	7,337.24	-2,894.71	224.80	40.136539	-104.699533	1,293,594.91	3,223,801.68
10,108.00	89.69	178.92	7,338.00	-2,988.71	225.55	40.136281	-104.699530	1,293,500.93	3,223,803.28
10,203.00	89.07	179.31	7,339.03	-3,083.69	227.02	40.136020	-104.699525	1,293,405.97	3,223,805.60
10,297.00	88.45	180.65	7,341.06	-3,177.66	227.05	40.135762	-104.699525	1,293,312.00	3,223,806.48
10,392.00	88.21	180.28	7,343.83	-3,272.62	226.28	40.135502	-104.699528	1,293,217.04	3,223,806.57
10,487.00	88.52	180.54	7,346.54	-3,367.58	225.60	40.135241	-104.699530	1,293,122.09	3,223,806.74
10,582.00	89.75	180.98	7,347.98	-3,462.56	224.34	40.134980	-104.699535	1,293,027.10	3,223,806.34
10,676.00	90.19	180.55	7,348.03	-3,556.55	223.09	40.134722	-104.699539	1,292,933.11	3,223,805.93
10,771.00	90.74	180.03	7,347.26	-3,651.54	222.60	40.134461	-104.699541	1,292,838.12	3,223,806.31
10,866.00	90.06	181.22	7,346.59	-3,746.53	221.57	40.134201	-104.699545	1,292,743.13	3,223,806.13
10,960.00	88.89	180.22	7,347.45	-3,840.52	220.39	40.133943	-104.699549	1,292,649.14	3,223,805.80
11,055.00	89.38	179.95	7,348.89	-3,935.51	220.25	40.133682	-104.699549	1,292,554.16	3,223,806.51
11,150.00	88.33	178.13	7,350.79	-4,030.47	221.84	40.133421	-104.699544	1,292,459.22	3,223,808.96
11,244.00	86.72	176.61	7,354.85	-4,124.28	226.15	40.133164	-104.699528	1,292,365.45	3,223,814.11
11,339.00	88.27	176.87	7,359.00	-4,219.03	231.54	40.132904	-104.699509	1,292,270.76	3,223,820.36

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	+E/-W (ft)	Geographic Coordinates Latitude (ft)	Longitude (ft)	UTM Coordinates Northing (ft)	Easting (ft)
11,381.00	88.52	176.94	7,360.17	-4,260.95	233.81	40.132789	-104.699501	1,292,228.86	3,223,823.01
11,427.00	88.52	176.94	7,361.36	-4,306.87	236.26	40.132662	-104.699492	1,292,182.97	3,223,825.88

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	+E/-W (ft)	Comment
25.00	25.00	0.00	0.00	H&P 308: RKB = 25ft
125.00	125.00	0.01	-0.27	First MS Energy Services Gyro @ 125.00ft
991.00	990.99	0.35	2.29	Final MS Energy Services Gyro @ 991.00ft
991.00	990.99	0.35	2.29	Tie-On to Surface Gyros @ 991.00ft
1,109.00	1,108.99	-0.07	2.71	First Sperry MWD Survey @ 1109.00ft
11,381.00	7,360.17	-4,260.95	233.81	Final Sperry MWD Survey @ 11381.00ft
11,427.00	7,361.36	-4,306.87	236.26	Straight Line Proj @ 11427' MD :: 7361.36' TVD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (ft)	+E/-W (ft)	Start TVD (ft)
User	No Target (Freehand)	180.17	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
25.00	991.00	MS Energy Services - Surface Gyros	NS-GYRO-MS
1,109.00	7,591.00	Sperry MWD Surveys - Vert/Build	MWD+IFR1+SC
7,703.00	11,381.00	Sperry MWD Surveys - Lateral	MWD+IFR1+SC

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,636.80	7,339.51	7" Casing Point @ 7636.8' MD :: 7339.51' TVD	7	8-3/4

Design Report for Crowder 16C-19HZ - Actual Field Surveys

Targets for Plan E Rev 0

Shape	Target Name	TVD (ft)	Northing (ft)	Easting (ft)	+N/-S ft	+E/-W ft	Created	Updated
Polygon	Crowder 16C-19HZ_LD shortened	0.00	1,296,487.36	3,223,550.80	0.00	0.00	03-28-2013	03-28-2013
Polygon	Crowder 16C-19HZ_SB 18 - newest	0.00	1,296,487.36	3,223,550.80	0.00	0.00	03-28-2013	03-28-2013
Polygon	Crowder 16C-19HZ_Sec18 - newest	0.00	1,296,487.36	3,223,550.80	0.00	0.00	03-28-2013	03-28-2013
Point	Crowder 16C-19HZ_BHL shortened	7,343.87	1,292,168.15	3,223,769.75	-4,321.18	180.00	03-28-2013	03-28-2013
Point	Crowder 16C-19HZ_SHL	0.00	1,296,487.36	3,223,550.80	0.00	0.00	07-24-2012	02-27-2013

North Reference Sheet for Sec. 18-T2N-R65W - Crowder 16C-19HZ - Plan E Rev 0

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.

Vertical Depths are relative to RKB=25 @ 4977.00ft (HP 308). Northing and Easting are relative to Crowder 16C-19HZ

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995856

Grid Coordinates of Well: 1,296,487.36 ft N, 3,223,550.80 ft E

Geographical Coordinates of Well: 40° 08' 40.15" N, 104° 42' 01.21" W

Grid Convergence at Surface is: 0.52°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,427.00ft

the Bottom Hole Displacement is 4,313.35ft in the Direction of 176.86° (True).

Magnetic Convergence at surface is: -8.11° (28 March 2013, , BGGM2012)

